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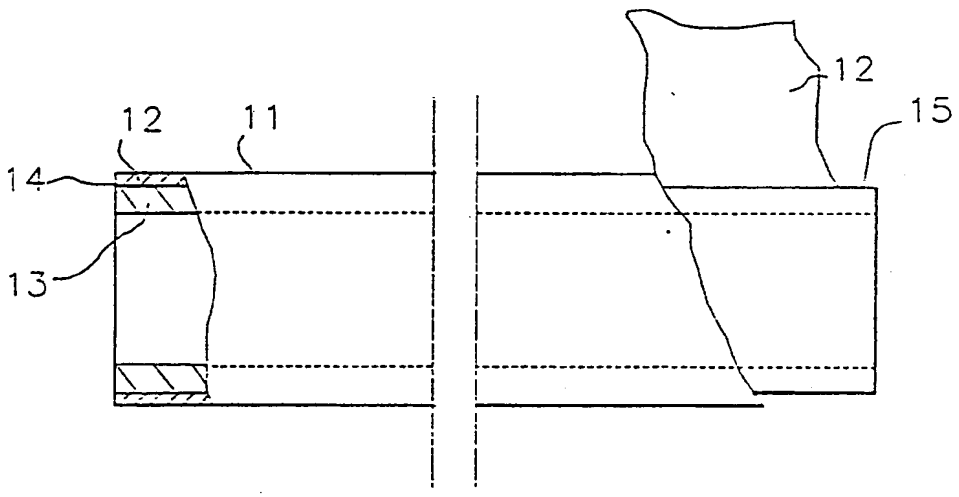

(57) Abstract

The invention relates to a method of coating a plastic pipe with a surface layer and a plastic pipe coated with a surface layer. The surface layer (12) is formed of plastic upon a pipe (13) into a protective coating by a suitable coating technique in such a way that the protective coating is easily detachable at least at the pipe ends.

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A method of coating a plastic pipe and a plastic pipe coated by the method

In the handling, installation and connection of plastic pipes, the pipe surface is extremely liable to damage. In modern plastic pipe installation techniques, for example, a tunnel is bored in the ground for the pipe, and the pipe is then pushed through the tunnel e.g. into an excavation where the following joint is to be made.

It is clear that the pipe becomes scratched and dirty when handled in this way. This is disadvantageous firstly as the pipe material may be notch sensitive, in which case scratches cause greater damages in the pipe during subsequent handling. Secondly, dirt on the pipes prevents successful welding. Today, PE pipes in particular are jointed together by electric welding (electrofusion socketing), and almost the only reason for unsuccessful welding by this technique is that the surface of the pipe is dirty or oxidized. Therefore the pipe ends always have to be cleaned with sand paper, for example, before jointing. In practice, the cleaning result is often uneven (the underside of the pipe is treated less carefully) and the quality depends on the professional skill of the worker.

A method of the present invention for coating a plastic pipe and a plastic pipe coated by the method aim at avoiding the above-mentioned problems in such a way that the electric welding of pipes ready for installation can be carried out by the welder without any laborious preparation steps.

The method of the invention is thus characterized in that the surface layer is made of plastic upon the pipe to form a protective coating by a suit-

able coating technique, and that the protective coating is made easily detachable at least at the ends of the pipe.

In addition to the obvious advantages associated with the protection of the pipe, the welding can be carried out more easily, and safety at work is increased when using the method of the invention. Safety at work and the quality of the work are also affected by the fact that the pipes simply cannot be welded without removing the coating within the joint area on account of the outer diameter of the pipes which is greater than normally. Consequently, jointing with mechanical joints and/or welding is always carried out with clean pipe ends, which ensures successful welding and appropriate performance of the working machines.

Other preferred embodiments of the method of the invention are characterized by what is disclosed in the accompanying claims.

The pipe of the invention is characterized in that the surface layer forms a protective coating on the pipe in such a way that the protective coating is easily detachable at least within the area of the pipe ends.

The protective coating provided in the pipe according to the invention also prevents UV radiation from reaching the surface layer of the pipe itself, where it would cause decomposition reactions. Today, plastic pipes are UV stabilized according to the requirements of each particular case by through-dyeing them with expensive colour agents often containing poisonous heavy metals. In a pipe provided with a protective coating this is not necessary but the UV protection and requisite dyeing are effected only in the protective coating with considerably lower costs

and reduced environmental effects.

Other preferred embodiments of the pipe of the invention are characterized by what is disclosed in the accompanying claims.

In the following the invention will be described in greater detail by means of examples with reference to the attached drawings, in which

Figure 1 shows one embodiment of the method of the invention;

Figure 2 shows another embodiment of the method of the invention; and

Figure 3 shows a pipe of the invention in a welding situation and partly in section.

In Figure 1, a plastic pipe 2 is coated by means of co-extrusion with a surface layer according to the method of the invention. The surface layer is extruded from molten plastic material 1 upon the pipe 2 of nominal size so as to form a protective coating 3. Co-extrusion nozzles 5, such as so-called crosshead nozzles, are obvious to one skilled in the art, and so the co-extrusion will not be described in any greater detail herein. Using means according to the basic method or other means to be described below, the protective coating is made easily detachable over its entire length or at least at the pipe ends. It is essential that the protective coating can be detached when required with simple means without the use of edge tools or other similar means causing scratches so as to keep the surfaces to be welded as intact as possible. One well-known way of removing the surface layer is to utilize the so-called peel-off effect, which is created when the strength properties of the coating are different in the radial and axial direction.

The surface layer 3 or protective coating of

the pipe 4 formed according to the invention can be made e.g of linear LDPE or recycled waste plastic. An advantage of linear LDPE is that, considering its price, it has a high scratch resistance and burst strength, whereas waste plastic is advantageous in that it is very cheap and especially suitable for the use according to the invention, which is highly tolerant e.g to variation in the quality of the plastic material. It is really an advantage that the protective coating is made of a plastic material which is poorly weldable or cannot be welded at all. In this way, the worker will notice at the welding stage at the latest if the protective coating should not have been removed.

It is also to be considered on selecting the material that if the protective coating formed by the surface layer of the pipe is made of a plastic differing chemically from the pipe material, the adhesion between the pipe and the protective layer will probably not be as good as when using similar materials. In addition, the adhesion properties between the pipe and the protective coating can be advantageously affected by adding a considerable amount of fillers to the protective coating, or by forming the protective coating on the pipe at a relatively low temperature. This can be contributed to with a suitable shaping of the tool so that e.g. a so-called cold seam is formed at the crosshead, opposite to the material feed point, and on the other side of the pipe, at which the coating tears easily. Both methods aim at making the surface of the protective coating to be formed relatively hard, that is, reduce its tendency to adhere, and making it relatively hard in structure, so that it is easy to detach from the pipe e.g. by knocking. Suitable

fillers include chalk and talc.

With reference to Figure 2, another embodiment of the method of the invention is shown, that is, coating of a plastic pipe 6 with a surface layer 7 to form a protective coating by spirally winding with a tangential nozzle 8. This coating method also enables "mechanical" detachment of the protective coating, that is, the surface of the pipe is revealed by removing the spirally wound protective coating by tearing from the end of the coating (cf. Figure 3).

In the case of co-extrusion, a suitable spiral tear seam can be achieved e.g. by rotating the tool 5 shown in Figure 1. Such an intentionally formed seam can further be formed into a "cold seam", thus further improving the tearing properties, by cooling the co-extrusion tool 5 locally by a water circulation, for example. The co-extrusion tool 5 can also be cooled locally in such a way that a longitudinal tear seam is formed in the surface layer 3. It is also possible to provide the protective coating with a longitudinal tear cord or with a thinner strip, whereby an easily tearable seam is obtained in the axial direction.

In these ways, a peel-off effect can be produced in the protective coating, which is characterized by that the strength properties of the layer are different in the radial and axial direction.

In one preferred embodiment of the method of the invention, an agent preventing adhesion is introduced between the pipe and the surface layer forming the protective coating at the coating stage. At the same time, taking into account the use for which the pipe to be formed is intended, it is also possible to introduce agents promoting weldability and/or crosslinking between the pipe and the surface

layer forming the protective coating. One suitable agent for improving welding properties is dicumyl peroxide. Crosslinking agents supplement the cross-linking reactions of the pipe material in the attachment surface and lubricates the surface, which is of advantage also in view of reducing the adhesion of the protective coating. Crosslinking agents may be the same generally known radicals as used in the matrix material of the pipe.

The above-mentioned agents can be introduced between the pipe and the protective coating e.g. through a separate nozzle 9 in the form of a thin plastic film 10 containing such agents, as shown in Figure 2. Of course, this type of layer can also be formed by co-extrusion.

Figure 3 shows schematically the structure of a pipe 11 according to the invention. The surface layer, that is, a protective coating 12 is formed upon a pipe 13 of nominal size in such a way that it is easily detachable.

The protective coating made of linear LDPE or recycled waste plastic, for example, is extruded on the pipe by co-extrusion or wound by a tangential nozzle. A sufficient amount of fillers is added to the protective coating to achieve a rigid structure, and colouring and UV stabilizing agents are also added, whereby no such agents are needed in the pipe to be protected. Accordingly, in one preferred embodiment of the invention, the pipe itself is of undyed plastic which has not been UV stabilized while the protective coating contains the identifying colour agents and UV stabilizing agents.

If the adhesion between the pipe and the protective coating cannot be adjusted to a desired level in any other way during the production process,

it is possible in one embodiment of the invention to insert a thin plastic film preventing adhesion between 14 the pipe and the surface layer forming the protective coating. In addition to agents preventing adhesion, this plastic film may also contain other desired agents to be introduced between the surfaces, such as agents promoting weldability and cross-linking.

When using the pipe according to the invention the protective coating 12 is peeled off at the ends 15 of the pipes to be welded together (cf. Figure 3); the pipe ends are positioned against each other; and the welding, such as electric welding (electrofusion socketing), is carried out in a known manner. Thereafter the pipe laying is continued as usual as the protective coating on the surface of the pipe does not affect the installation in any way.

It is obvious to one skilled in the art that the different embodiments of the invention are not restricted to the examples described above, but they may vary within the scope of the accompanying claims.

Claims:

1. Method of coating a plastic pipe with a surface layer, characterized in that the surface layer (3; 7; 12) is made of plastic on the pipe (2; 6; 13) to form a protective coating by a suitable coating technique, and that the protective coating is made easily detachable at least at the ends of the pipe.

2. Method according to claim 1, characterized in that the surface layer (3) is formed upon a pipe (2) of nominal size as a protective coating by co-extrusion.

3. Method according to claim 2, characterized in that the co-extrusion tool (5) is rotated so as to form a spiral seam in the surface layer (3).

4. Method according to claim 2, characterized in that the co-extrusion tool (5) is cooled locally so that a longitudinal seam is formed in the surface layer (3).

5. Method according to claim 1, characterized in that the surface layer (7) is formed on a pipe (6) of nominal size as a protective coating by a tangential nozzle (8) by spirally winding.

6. Method according to any of claims 1 to 5, characterized in that the protective coating (3; 7; 12) formed by the surface layer of the pipe (2; 6; 13) is made of linear LDPE.

7. Method according to any of claims 1 to 5, characterized in that the protective coating (3; 7; 12) formed by the surface layer of the pipe (2; 6; 13) is made of recycled waste plastic.

8. Method according to claims 1 to 7, char-

a c t e r i z e d in that the protective coating (3; 7; 12) formed by the surface layer of the pipe (2; 6; 13) is made of a plastic differing chemically from the material of the pipe.

9. Method according to any of claims 1 to 8, c h a r a c t e r i z e d in that a substantial amount of fillers is added to the protective coating (3; 7; 12) of the pipe (2; 6; 13).

10. Method according to any of claims 1 to 9, c h a r a c t e r i z e d in that the protective coating (3; 7; 12) is formed on the pipe (2; 6; 13) at a relatively low temperature to reduce its adhesion to the surface of the pipe.

11. Method according to any of claims 1 to 10, c h a r a c t e r i z e d in that an agent preventing adhesion is introduced between (14) the pipe (2; 6; 13) and the protective coating (3; 7; 12) at the coating stage.

12. Method according to any of claims 1 to 11, c h a r a c t e r i z e d in that an agent promoting weldability is introduced between (14) the pipe (2; 6; 13) and the protective coating (3; 7; 12) at the coating stage.

13. Method according to any of claims 1 to 12, c h a r a c t e r i z e d in that an agent promoting crosslinking of the pipe material is introduced between (14) the pipe (2; 6; 13) and the protective coating (3; 7; 12) at the coating stage.

14. Method according to any of claims 9 to 13, c h a r a c t e r i z e d in that the agents to be introduced between (14) the pipe (2; 6; 13) and the protective coating (3; 7; 12) are introduced between the pipe and the protective coating at the coating stage through a separate nozzle (9) in the form of a thin plastic film (10) containing these agents.

15. Plastic pipe coated with a surface layer, characterized in that the surface layer (3; 7; 12) forms a protective coating on the pipe (2; 6; 13) in such a way that the protective coating is easily detachable at least within the area of the pipe ends.

16. Plastic pipe according to claim 15, characterized in that the surface layer (3; 7; 12) is formed on a pipe (2; 6; 13) of nominal size as a protective coating.

17. Plastic pipe according to claim 15 or 16, characterized in that the protective coating formed by the surface layer (3; 7; 12) is of linear LDPE.

18. Plastic pipe according to claim 15 or 16, characterized in that the protective layer formed by the surface layer (3; 7; 12) of the pipe is of recycled waste plastic.

19. Plastic pipe according to any of claims 15 to 18, characterized in that the protective coating formed by the surface layer (3; 7; 12) of he pipe is of a plastic differing chemically from the material of the pipe.

20. Plastic pipe according to any of claims 15 to 19, characterized in that a substantial amount of fillers is added to the protective coating (3; 7; 12) of the pipe.

21. Plastic pipe according to any of claims 15 to 20, characterized in that an agent preventing adhesion is introduced between (14) the pipe (2; 6; 13) and the protective coating (3; 7; 12).

22. Plastic pipe according to any of claims 15 to 21, characterized in that an agent promoting the weldability of the pipe is introduced

between (14) the pipe (2; 6; 13) and the protective coating (3; 7; 12).

23. Plastic pipe according to any of claims 15 to 22, characterized in that an agent promoting the crosslinking of the pipe material is introduced between the pipe (2; 6; 13) and the protective coating (3; 7; 12).

24. Plastic pipe according to any of claims 21 to 23, characterized in that a thin plastic film (10) containing the desired agents to be introduced between the pipe (2; 6; 13) and the protective coating (3; 7; 12) is inserted between (14) the pipe and the coating.

25. Plastic pipe according to any of claims 15 to 24, characterized in that the pipe (2; 6; 13) is of undyed plastic which has not been UV stabilized while the protective coating (3; 7; 12) contains the identifying colour agents and UV stabilizing agents of the pipe.

26. Plastic pipe according to any of claims 15 to 25, characterized in that the strength properties of the protective coating (3; 7; 12) are different in the radial and axial direction.

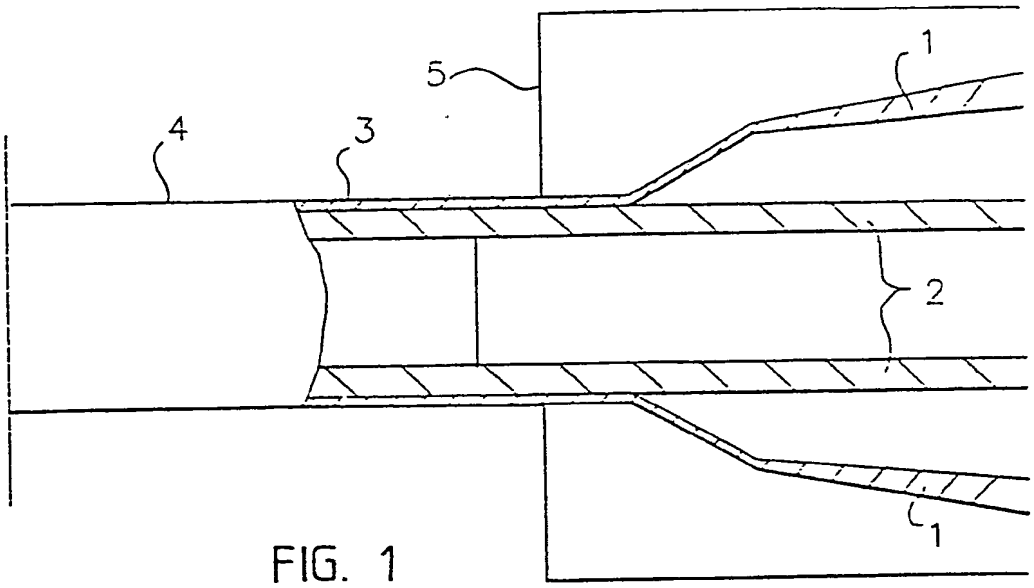

FIG. 1

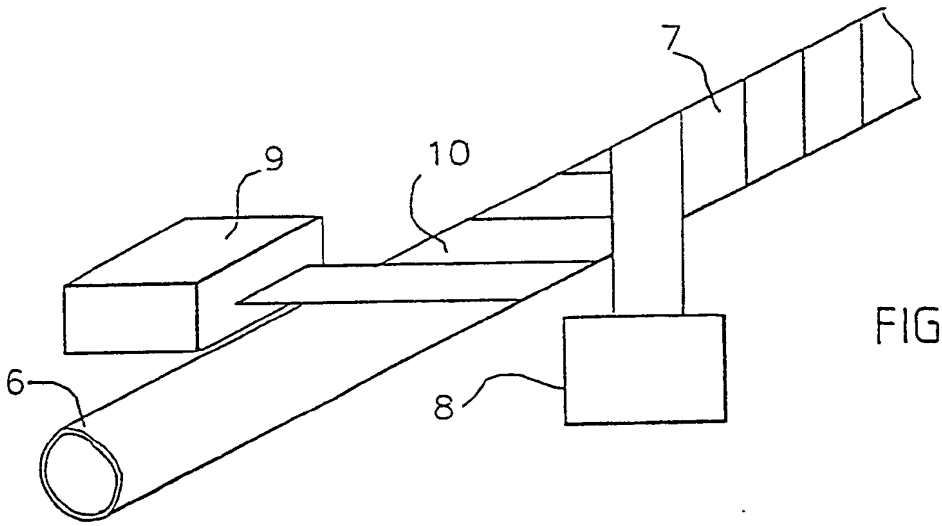

FIG. 2

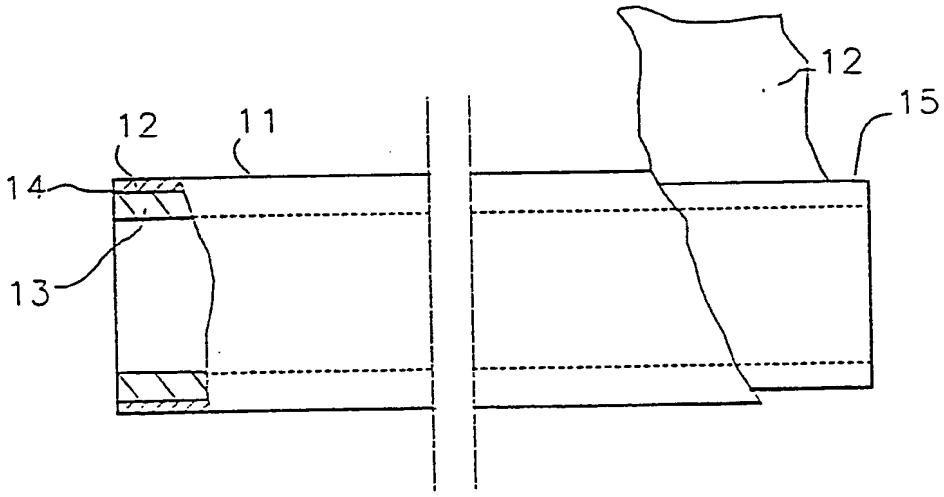

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00201

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 29 C 47/02, 63/06, B 65 D 85/20

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 29 C; B 65 B; B 65 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	GB, A, 1415272 (YOSHIDA KOGYO K.K.) 26 November 1975, see page 1, line 65 - line 75; figures 2,4 --	1-26
X	DE, A1, 2812701 (KABEL- UND METALLWERKE GUTEHOFFNUNGSHÜTTE AG) 4 October 1979, see page 5, line 8 - line 18; page 6, line 7 - line 9; figure 1; claim 1 --	1-26
X	GB, A, 2226788 (VACTITE LIMITED) 11 July 1990, see page 1, line 16 - page 2, line 19; page 4, line 2 - line 13; abstract; figure 1; claims 1,2,3 --	1-26

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
17th September 1992	28 -09- 1992
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Kristina Sköld

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
X	GB, A, 2202484 (KEITH RICHARD PATTERSON) 28 September 1988, see abstract; figure 1 --	1-26
X	DE, A1, 3209600 (KABELMETAL ELECTRO GMBH; KABEL- UND METALLWERKE GUTEHOFFNUNGSHÜTTE AG) 22 September 1983, see page 4, line 12 - line 19; page 5, line 7 - line 16; abstract; figure 1; claims 1,2 --	1-26
A	Patent Abstracts of Japan, Vol 10, No 62, M460, abstract of JP 60-208218, publ 1985-10-19 (SHIN NIPPON SEITETSU K.K.) --	1-26

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00201

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 28/08/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
GB-A- 1415272	75-11-26	AU-D-	6601874	75-08-28
		BE-A-	812001	74-07-01
		DE-A-	2411610	74-09-26
		FR-A-B-	2221361	74-10-11
		JP-C-	967913	79-08-31
		JP-A-	49133164	74-12-20
		JP-B-	53011903	78-04-25
		NL-A-	7403218	74-09-16
DE-A1- 2812701	79-10-04	AT-B-	361839	81-04-10
		BE-A-	873816	79-05-16
		FR-A-	2420490	79-10-19
		JP-A-	54131493	79-10-12
		NL-A-	7902050	79-09-25
		SE-A-	7902566	79-09-24
GB-A- 2226788	90-07-11	EP-A-	0377275	90-07-11
GB-A- 2202484	88-09-28	NONE		
DE-A1- 3209600	83-09-22	FR-A-	2516443	83-05-20
		GB-A-B-	2111164	83-06-29
		NL-A-	8204208	83-06-16
		SE-A-	8206476	83-05-17